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ABSTRACT

The concepts, vocabulary, current uses, and technical aspects of distance education are introduced in this bulletin, which is designed to assist administrators in making decisions regarding distance education. The first chapter defines and discusses distance education in general and provides an overview of current educational applications. Self-assessment questions and guidelines are included. Chapter 2 explains the various technologies and hardware, defines technical terms, and addresses needs assessment. A synthesis of the current uses of distance education, which is essential to know before discussing implementation, is provided in the third chapter. Chapter 4 offers examples of current uses of distance education in the United States and in other countries. The fifth chapter examines financial, logical, and implementation issues, presenting sample cost estimates for initiating distance education in a school district and offering suggestions for planning for the accompanying changes. Three tables are included. Appendices contain a glossary of distance education terms and resources on distance education learning. (71 references) (LMI)

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Preface

Distance education is a topic of interest to school districts around the country. Administrators are asking questions about what these new technologies might mean for their individual circumstances and populations. Is it appropriate for your school district?

The purpose of this Bulletin is to introduce the concepts, vocabulary, current uses, and technical aspects of distance education. It will assist administrators as they consider entering the world of distance delivery so that a careful and informed decision can be made.

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Contents

Introduction

As people around the world become more interconnected by technology, the desire for information and knowledge drives educators, students, and the entire educational agenda. We live in an age in which new technological opportunities abound. For those who want to take advantage of these opportunities, the prospect of choosing among existing technological options can be intimidating. It is essential that these decisions be made in an informed, thoughtful manner.

It is now possible for schools to use interactive video instruction in subjects such as Japanese, matrix algebra, and advanced chemistry. Technology can bring Shakespearean plays to students in isolated locations or allow face-to-face meetings with authors or subject matter practitioners. And it can enhance teacher inservice training by enabling those in remote locations to confer with experts and interact with colleagues regardless of geographic location.

A UCLA study projects that by 2010 more than 50 percent of all educational instruction in the U.S. will be "mediated education," that is, instruction that is conveyed through some form of technology (J.N. Pelton 1991). Unfortunately, many administrators are in the difficult position of recommending the inclusion of valuable but expensive new programs at a time when school funding is tight.

This Bulletin is designed to assist administrators and district teams in making decisions regarding distance education. It explores some questions about distance education, such as, Does your school district need it? What are the positive and negative results of adopting these new technologies? If you choose to implement distance education, what are your options and how much do they cost? What kinds of technologies are right for your needs? And, how do you maintain sensitivity to the needs of staff, students, and parents when implementing this innovative approach to education?

The first chapter defines and discusses distance education in general and provides an overview of current educational applications. Self-assess-

ment questions and guidelines to help focus your reading of the other chapters are also included. Chapter 2 explains the various technologies and hardware and defines technical terms. This chapter reviews available technology and addresses needs assessment.

Chapter 3 provides a synthesis of the current uses of distance education, which is essential to have before discussing the idea of implementation with school boards, educators, and parents.

Chapter 4 offers examples of current uses of distance education in the U.S. and in other countries. These examples illustrate how distance education has been used to meet a variety of educational needs.

Some sample cost estimates for initiating distance education in a school district are offered in chapter 5. This chapter also provides some suggestions for the changes that will accompany distance education. Once a decision has been made to utilize one or more forms of distance education, several additional decisions and plans will need to be considered, and these are also disucssed in this chapter.

Finally, a list of vendors, further readings, other materials, and sources of support appears in the Appendix.

Chapter 1

What Is Distance Education?

Imagine a classroom of seventh-grade science students exploring the bottom of the Mediterranean Sea as a remote-controlled robot traverses the ocean floor and sends signals back to the mother ship via fiber optic cable. The students, watching as an international satellite broadcasts the signals to classes around the world, observe and interact with scientists on the ship as they interpret archaeological and oceanographic wonders.

This example demonstrates one potential use of new technology, but there are other scenarios in which this technology addresses the diverse needs of citizens:

- Innercity youth, unemployed, out of school, and in many ways at risk, come to a community center where they communicate with others via computers, learn basic academic skills, and gain confidence.
- A blind history professor, with a talking word processor and Braille printer, teaches classes and communicates with students through his computer and modem.
- Geographically isolated students go to school through satellite transmission; they interact with colleagues over voice phones and computer, fax homework to the teacher, and share with others the meaning they construct from their experiences.

These learners and learning situations have many things in common; most notably, they are examples of decentralized learning that are educationally and technologically feasible. Today distance education can

> cross difficult physical and social boundaries, reach minorities, high risk learners, and the handicapped, overcome the tyranny of time and distance and equalize opportunity for our nation's disenfranchised. (Ohler 1989, p. 1)

We could be moving toward a "learning society" where education becomes the purpose of living rather than a preparation for it (Hutchins 1968). It is possible that the infusion of distance learning into the traditional educational paradigm will transform society; learners could move closer to becoming "educated, cooperative, technologically competent citizens" (Ohler 1989, p. 1). Yet uncertainty exists about how to proceed.

A Definition and History of Distance Education

Distance education represents a way of communicating with geographically dispersed individuals and groups. For purposes of this Bulletin, it will be defined as "the quasi-permanent separation of teacher and learner, the use of technical media and the provision of two-way communication" (Keegan 1986, p. 49). In the international community, large numbers of students in higher education are distant learners as opportunities are brought directly into homes and offices.

For the last 150 years, correspondence education has also been used to deliver instruction to place-bound individuals. This was accomplished primarily by mailing printed copies of class lectures and assignments. The earliest distance tutoring courses taught shorthand and started in England in 1840, soon after a national postal system was introduced. In the United States, mobile learning opportunities, such as chautauqua, proliferated, especially in rural settings. Since World War I, distance education has spread rapidly; it is now known in some form all over the world. As other media and technologies became available, they have been incorporated into distance education: newspapers, radio, television, telephones, satellite transmission, electronic publishing.

Millions of learners throughout the world have experienced distance education. In China, for example, almost 50 percent of postsecondary students use distance learning; in the Soviet Union, 30 percent; in East Germany, 25 percent (U.S. Congress 1989, p. 25). Now the geographically and physically separated can have access to courses and instruction as technology is able to deliver information in a timely and more interactive manner. Distance education has unique characteristics (speed, interactivity, multiple locations, and a variety of communication techniques) that allow teacher and learner to interact over distance in almost traditional ways.

In the United States, distance education at the adult level was originally confined to military, corporate, and university continuing education. In the last five years, however, this situation has changed dramatically. Higher education has been diversifying, more people have become interested in postsecondary education, and societal pressures have forced institutions to

offer a wide variety of course delivery options. The federal government has sponsored and encouraged the growth of technological hardware infrastructures and has offered grants to develop model programs.

Current Status of Distance Education in the United States

The Office of Technology Assessment (OTA) recently published *Linking for Learning: A New Course for Education*, a report that discusses the current status of distance education in the United States. According to *Linking for Learning*, virtually all states are involved in distance education at some level (U.S. Congress 1989, p. 27). States are key players in distance education because they have a legal responsibility to implement specific aspects of education. Also, states are the "governmental level at which cooperation or collaboration is most feasible between agencies which deal with various components of distance delivery" (Holznagel and Olson 1990, p. 4).

Distance education involves a complex interaction of people, technologies, systems, and processes. The variety of technologies alone has implications for regulatory agencies. Within one state, a number of departments may be independently formulating telecommunications and broadcast policy. Frequently, these policies contradict or interfere with each other.

As states have moved to set policy for distance education, a variety of models to accomplish this task have emerged. It might be expected that the state education agency would claim primary responsibility; however, in some states that has not occurred. A recent review of states' efforts found that

> policy may emanate from the public television organization, the state agency regulating telecommunications, the state university system, the teacher certification agency, or the State Education Agency. State policy is most likely a combination of two or more of these. (Holznagel and Olson 1990, p. 3)

It will be useful for districts to become familiar with the situation and organizational structure in their state. In some cases, support and information may be available directly from the state. For example, several states offer financial support for districts that adopt distance education.

Current Activities

Distance education is an emerging phenomenon, and information changes rapidly. Currently, there are four main providers of distance education programming, with several new initiatives just beginning. One federal

initiative has played a significant role in encouraging the development of this form of education.

These major providers have benefitted from the communication satellites that circle the globe. Since the early 1960s, when President Kennedy signed the Satellite Communications Act and the first satellites were launched, we have been able to communicate at a distance. By the late 1970s, many countries and private companies were launching their own satellites, which increased competition and lowered costs.

Texas Interactive Instructional Network (TI-IN), based in San Antonio and founded in 1985, was the first private long-distance television network to offer educational resources. It offers live interactive satellite-delivered courses to high school students in forty states. With almost 1,000 sites and nearly 6,000 students, the network expects to have revenues in the neighborhood of $12 million.

In 1984, the Texas legislature required districts to offer any course requested by ten or more students. Satellite delivery of some courses was an acceptable alternative for small rural districts. Since its modest beginnings, the network has grown to offer many high school classes. It also now provides professional development activities to teachers, administrators, and staff. In addition, TI-IN has expanded the types of interactive responses by using push-button talk-back phones, electronic writing tablets, and electronic mail (these will be discussed in detail in chapter 2).

Oklahoma State University is the home of another popular satellite network, Arts and Sciences Teleconferencing Service (ASTS). In the 1983-84 school year this network began offering enrichment programming. Soon they developed and began offering German language courses that were widely recognized as exceptional. More than fifty schools signed up within the first year. One unique feature of this class is the inclusion of certified teacher partners onsite for remote students. These teachers use computer-assisted instructional software packages provided by the network as complementary class material.

Satellite Educational Resources Consortium (SERC) began as a partnership between state departments of education and state educational broadcasting networks in eighteen states. The focus is on science, math, and foreign languages. Most courses are delivered five days per week, and more than 5,000 students currently participate. This network has included an interactive key pad for its Probability and Statistics course, enabling students to exchange data during the live broadcasts. In addition, science seminars, teacher inservice training workshops, and a graduate education class are offered.

Washington State's Satellite Telecommunications Educational Programming (STEP) network offers programming to over 100 school districts.

The focus of this network is on staff development, foreign languages, and sciences. From its broadcast center at Eastern Washington University, STEP offers programming to eight western states.

One of the newer organizations is an ambitious satellite system developed by Kentucky Educational Television. Dubbed Star Channels, this system began with a startup appropriation of $11.4 million from the Kentucky legislature. In a similar startup situation, Oregon committed $8 million to begin ED-NET, which was designed to use satellite, microwave, data, and other interactive technologies to deliver courses around the state. Missouri's Education Satellite Network offers courses and programming to 350 sites in the Midwest.

Star Schools Initiative

A federal effort to support distance education has had a major impact on the growth and development of technological delivery in the United States. An Omnibus Trade Bill and Competitiveness Act, passed by Congress in 1988, created the Star Schools Program. This program was intended to "address two critical needs in the rebuilding of our educational system to meet domestic and international challenges" (U.S. Congress 1988, p. 1). It focused on creating multistate, organizationally diverse partnerships to write and deliver curriculum and creating remote instruction opportunities for disadvantaged students.

In 1988, the Department of Education awarded $19 million to four partnerships. This first group of grantees included the TI-IN Network, based in San Antonio, Texas; the Satellite Educational Resources Consortium (SERC) based in Columbia, South Carolina; the Midlands Consortium, based at Oklahoma State University; and the Technical Education Research Centers, Inc. (TERC), based in Cambridge, Massachusetts. The first three provide satellite-delivered courses, and TERC focuses on computer information in science. The partnerships share programming, thereby expanding each region's access to collaborative projects.

In the fall of 1990, another round of grants were awarded for a total of $14.3 million. This group included partnerships in the following areas: Central Education Telecommunications Consortium, based in Washington, D.C.; Pacific Northwest Educational Telecommunications Partnership, based in Spokane, Washington; Reach for the Stars: Massachusetts Corporation for Educational Telecommunications, based in Cambridge; and Telecommunications Education for Advances in Mathematics and Science Education, administered by the Los Angeles County Office of Education. These programs have had an impact on many regions of the country. School administrators

should find out whether their district is affiliated with one of them.

Concern over News Programs

Recently a controversy has surfaced regarding news programs delivered into high school classes. Whittle Communications initiated its Channel One daily news and information program, designed to "make the news relevant to the concerns and studies of teenagers." Channel One is delivered by satellite to schools who agree to certain conditions. Schools are given a free satellite dish, VCR, and classroom monitors only if they agree to make the twelve-minute program a mandatory part of every school day for every student.

Most controversy has been focused on the fact that two minutes of commercials are incorporated into the broadcast. The ten minutes of news, described as the "MTV of news" by one student, provides brief overviews of major daily news events (Walsh 1989, p. 31). Several schools currently using the programs are in the process of evaluating the impact on the students, but so far little research has been published regarding this use of satellites.

In contrast to the Channel One programming, Ted Turner is offering a fifteen-minute news show free to all schools, via his cable broadcast channel. The show is transmitted in the middle of the night, so that anybody with a VCR can record it. There are no restrictions about when or to whom it must be shown, or the number of days the programs may be kept. The fifteen-minute show is free of commercials, with eight minutes highlighting major news events and the remainder focusing in depth on special topics. In addition, programming guides are provided to teachers at no cost.

When Channel One began, some states immediately banned it in their schools. Others believe both programs stimulate increased awareness among students. One concern is that some poor school districts may comply with the restrictions outlined by Whittle Communications just to obtain needed hardware, without evaluating specific programs or their effect. Others have been concerned that schools without VCRs cannot utilize the Turner news show. Some of these same issues confront other areas of technology implementation in the schools, and it appears there are no easy answers.

Questions to Consider

The most commonly identified reasons for adding distance education into a school system include compensation for lack of qualified teachers, provision of a more cost-efficient mode of operation, provision of flexible

programming on highly specialized and unique courses, and delivery of up-to-date information on a regular basis.

If your district is considering distance education, you must first identify your needs to ensure that you will make a decision you can live with for a long time. This section will assist you in deciding whether your district will benefit from introducing distance learning. With careful consideration, the decision to add this type of education will not become a technological solution in search of an educational problem.

Is Distance Education Right for Your District?

First, are you in a geographic or educationally isolated area? Are there students who do not have access to the types of courses they need? In many districts, especially those in rural areas, administrators are caught in a dilemma. States are demanding that students meet more stringent graduation requirements just as districts are losing pupils and reducing course offerings. Further, students from these districts who wish to attend universities expect to be able to take advanced classes.

Are educators in the district able to meet all their professional development needs, or are you located in an area that is geographically separated from a university with a college of education? Educators have an ongoing need for enhanced, updated information. Frequently their salary is increased only by continuing their formal educational experiences. Additionally, knowledge of new issues and topics is frequently required, necessitated by mandated programs such as AIDS education.

Distance education has been very successful in providing this type of professional development for educators. Educators can save on travel expenses and time by gathering together in their geographic area and having access to experts and programming from anywhere in the state or nation. Firsthand experience allows educators to develop strategies for learning using distance technologies. These methods can then be passed along to students.

Will Students Benefit?

Second, are there sufficient opportunities for students to learn through independent study? Are there highly motivated students who wish to learn on their own? We know that the most successful distance learners tend to be those who are highly motivated and who have a specific reason for taking the course. Are there students in your district who meet these criteria? For example, are there students who might benefit from community college classes, whether vocational or academic?

How Will It Fit in with Your Existing Technology?

Third, what is the status of technology in your district? Are district computers being fully utilized and having an impact? Do all participants in the district have equal access to the available technology? Is the staff familiar and comfortable with using a variety of technologies? These questions really ask for consideration on two levels

At one level, students and faculty have a right to become knowledgeable users and consumers of information technologies. Schools have some responsibility to ensure that they are teaching content appropriate for the next century. At another level, distance education has the potential of bringing courses and information into a district that might not otherwise be available. In addition, introduction of distance education and its supporting technology is often a positive experience that increases staff and student comfort with technologies. Faculty who have had a successful course or teleconference are more disposed to suggest a distance education program to students.

Policy Issues

Finally, there are many policy issues that need to be considered throughout the implementation of distance learning programs:

•*Scheduling*. Some courses are offered at very early hours or after school, or the timing conflicts with traditional school schedules. This has not been a problem in some cases; students attend half a study hall or miss fifteen minutes of their next class. However, students who have difficulty managing their own time and who are not self-starters can end up doing poorly with this type of situation.

•*Interaction*. In the past, distance education had little or no interaction; for example, radio and television broadcasts, videotapes, and correspondence education did not allow for two-way communication. Consideration must be given to appropriate activities for specific amounts of interaction. Obviously, one would not want a brain surgeon to learn her skills with only an audiotape. On the other hand, learning a foreign language might be done successfully with audio interaction.

•*Cultural sensitivity*. In the United States education is a state function that is locally controlled, and many local districts guard this task zealously. A district might want to be certain it can preview lessons to gain an understanding of the material delivered. Is the content sensitive to cultural, gender, and racial issues? Is it representing one view of the curriculum? This may not be quite so obvious in an advanced algebra class, but imagine a remote Native American village receiving a course on history that did not devote time to an account of the village's history.

•*Staff involvement in planning*. While this may seem to be an obvious concern, it does tend to become complex. Faculty will need to be involved in

the planning, staff training, and publicity efforts if they are expected to help in making a successful implementation.

•*Financial considerations.* In a time of limited resources, one does not commit a large amount of money without careful planning and budgeting. Usually a new project must replace something already in a budget, which means someone's favorite program may have to be cut.

These last several issues will be addressed more fully in chapter 5; however, it is important to begin considering them. Other issues may apply to individual districts, but the areas mentioned above are fairly universal considerations in districts beginning the task of introducing distance education into their community.

The stage has now been set with an overview of the players and present status of distance education. This chapter has provided a framework for the rest of the information in this Bulletin, and has suggested a few areas of potential difficulty. Next, chapter 2 describes the various technologies currently being used around the country and the world.

Chapter 2

Technological Alternatives

Today's electronic advances provide us with many types of hardware from which to choose. Unfortunately, distance education choices are frequently made without complete information on all possible technologies. This chapter describes available technologies, points out the advantages and limitations of each, and identifies their uses.

Distance education has existed for many years, but primarily as a text-based correspondence system. Now technologies allow us to expand the educational framework to include video, audio, and graphics. These additional modes of interaction promote visual learning, introduce new environments, encourage global connections, and enhance motivation for learning.

Everett Rogers (1983) defines *communication* as a two-way exchange of information, the aim of which is to achieve mutual understanding about a new idea. We can accomplish this in a variety of ways, but all communication systems have similar basic components, regardless of how sophisticated they may be. When children communicate using two tin cans and a string, they are participating in a process with the following components:

- *An information source:* the child who is going to speak is an information source.
- *An information encoder:* the child's vocal tract takes ideas and encodes them into speech or vibrations from the tin can on a string; his or her vocal chords create changes in the air forming waves, peaks, and valleys, or vibrations.
- *A communication channel:* the piece of string.
- *A receiver:* the other tin can that converts the vibrations into sounds.
- *A decoder:* the recipient's ear and brain, which translate the sounds into words and ideas.

Figure 1. Communication Exchange

- *A recipient:* the person to whom the child is talking. (Dordick 1986, p. 25)

Modern communications substitute a variety of electronic technologies to accomplish the same activities; however, they do it over longer distances and in a somewhat more reliable fashion.

Technology includes multiple facets and has been defined in many ways. Pacey characterizes technology as possessing three components. First, there is a cultural aspect, which includes goals, values, and ethical codes, belief in progress, awareness, and creativity. Next is the organizational aspect, which includes economic and industrial activity, professional activity, users and consumers, and trade unions. Third, there is a technical aspect of knowledge, skill, and technique; tools, machines, chemicals, liveware; resources, products, and wastes (Pacey 1983, p. 6). The last aspect reflects a restricted concept of technology, but is the one that will be the focus of this discussion.

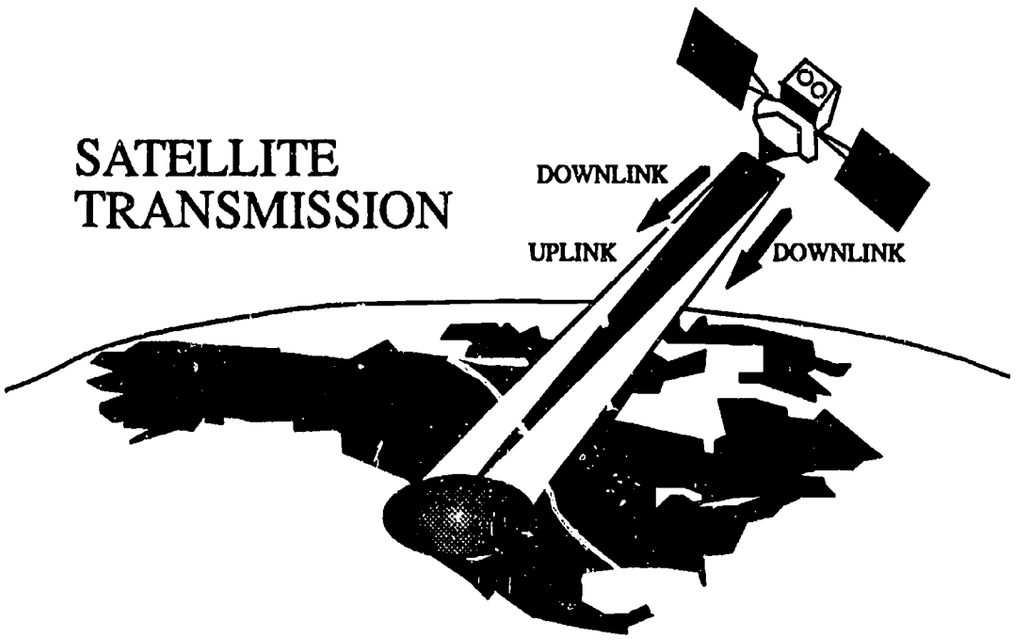
Communication Delivery Systems

Communication can be delivered by a variety of systems: satellites, microwave, cable, optical fiber, and computers.

Satellites

Satellites are intended to serve large geographic areas with broadcast quality channels. The most common use for this technology has been the

Figure 2. Satellite Transmission



Source: Oregon Ed-Net Promotional Materials.

delivery of courses—for example, Japanese or calculus—to rural and isolated schools where there may not be a qualified teacher. Satellites are also used for teleconferences, where meetings are held among participants in a variety of locations. Not only can satellites link large audiences and distant parts of the earth with little difficulty, but the cost of renting satellite transmission time has decreased in recent years. Use of communication satellite transmissions for teleconferences and distance education classes in the United States and other countries began in the late 1970s and became quite popular by the early 1980s.

Satellite delivery of programming is accomplished by renting a piece of a satellite called a transponder. A transponder works by receiving a signal from Earth, converting it to another frequency, amplifying it, and beaming it back to Earth. A large downlink satellite dish (a receiver dish that captures the programming for display), typically located on a roof or near the school, effectively catches the signal. The signal is then sent from the receiver dish to a monitor located in one or more classrooms.

Video transmissions may be either one way or two way, but the majority of the programming uses only one-way video. An originating site sends out a video and audio signal to any number of remote locations, which in turn have the ability to feed back audio communication over telephone lines. In a typical class with one teacher and five remote locations, students can see the teacher, hear him or her, and ask questions using a push-to-talk telephone. The teacher cannot see the students.

Teleconferences take place when it is necessary for several geographically dispersed individuals or groups to communicate with one another. This type of video conferencing can essentially become a closed-circuit TV broadcast by scrambling the signal. Again, it is possible that one location is the origination point, and the others are only able to communicate via audio back to the main hub. It is also possible that two sites have the ability to originate video signals; in that case everyone would be able to see and talk to the other locations.

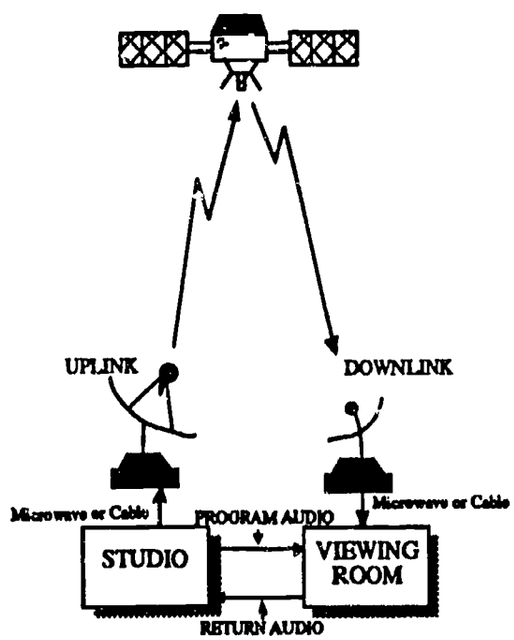
Satellite Delivery Decisions

One important decision to make concerns the type of receiver dish to purchase. These dishes can vary in size and can be steerable to pick up numerous satellites or fixed permanently on a single satellite. A smaller dish will cost less to buy and install; however, the quality of signal reception is affected by size. A smaller dish may limit which satellite transponders can be received. It is important to make sure the dish can adequately receive the signal from the satellite that will be used by the organization originating the program.

Another decision—most distance learning networks will have already made this one for you—involves choosing which band to use to deliver the signal to your satellite receiver dish. Two distinct bands broadcast this signal to the receiver dishes, and they are distinguished by the part of the frequency spectrum they use. The C-band uses a lower frequency, is not susceptible to weather conditions, and does not require a strict alignment to the satellite.

The second available satellite frequency is the KU-band. The KU-band operates at a higher frequency, can operate with a smaller receiver dish, but is extremely susceptible to weather conditions, especially rain. The higher frequency requires precise alignment

Figure 3. Basic Satellite Signal Path



Source: Los Angeles County Office of Education 1987.

with the satellite. More and more satellite dishes are designed to receive both C- and KU-band. Usually such dishes are more expensive and require specific alignment for each band width.

Another question to ask in the decision to use satellite transmission concerns the quality of the broadcast. Full-motion video provides high quality resolution and motion reproductions, and it is expensive to transmit because it requires the use of a full satellite transponder. Another possibility is to compress the video. Compression is a digital transmission technique used to transmit multiple video channels on a single transponder, thereby using less bandwidth. The disadvantage is that quality is compromised. Picture clarity is generally not as good as full-motion; quick movements often appear blurred. To provide the compressed video transmission in association with two-way audio, each site requires a "codec," an electronic device that converts and compresses analog video signals into digital signals. Then the signals can be transmitted and decoded on the receive end with another codec.

Although compressed video is less expensive to transmit, for certain distance education classes it may not be feasible. Nevton Dunn, an Oregon Public Broadcasting engineer who has long followed and been involved with distance technologies, said, "Compressed video is terrible stuff; you cannot see small movements for language." For example, in the delivery of a Japanese class, where minute movements of the mouth are extremely important, compression may not provide a clear representation of what is happening. Typically, K-12 programming is produced in full-motion video format.

Microwave Delivery

Microwave uses high-frequency radio waves for the transmission of audio, video, or data through the air. Line-of-sight signals from towers are amplified and retransmitted. Microwaves can transmit approximately eighty miles, depending on topography, antenna size, transmitter power, and receiver sensitivity.

An advantage of microwave systems for distance education is the control over the receivers. Unlike satellite transmission, which broadcasts a signal so that anyone with a receiver dish can see the program, microwave delivers a point-to-point or point-to-multipoint signal. A community college, for example, can broadcast to nearby high schools so students don't have to commute to the campus each day.

The price of using microwave is substantially less than that of satellite delivery, but the distribution is restricted to regional sites. Microwave may prove to be the perfect answer if your goal is to deliver college preparatory classes, or advanced placement classes, to a few high school students. Another example of the use of this technology might include a community

college with a mandate to cover a large geographic area. Offcampus sites could save students hours of travel time and also be relatively inexpensive.

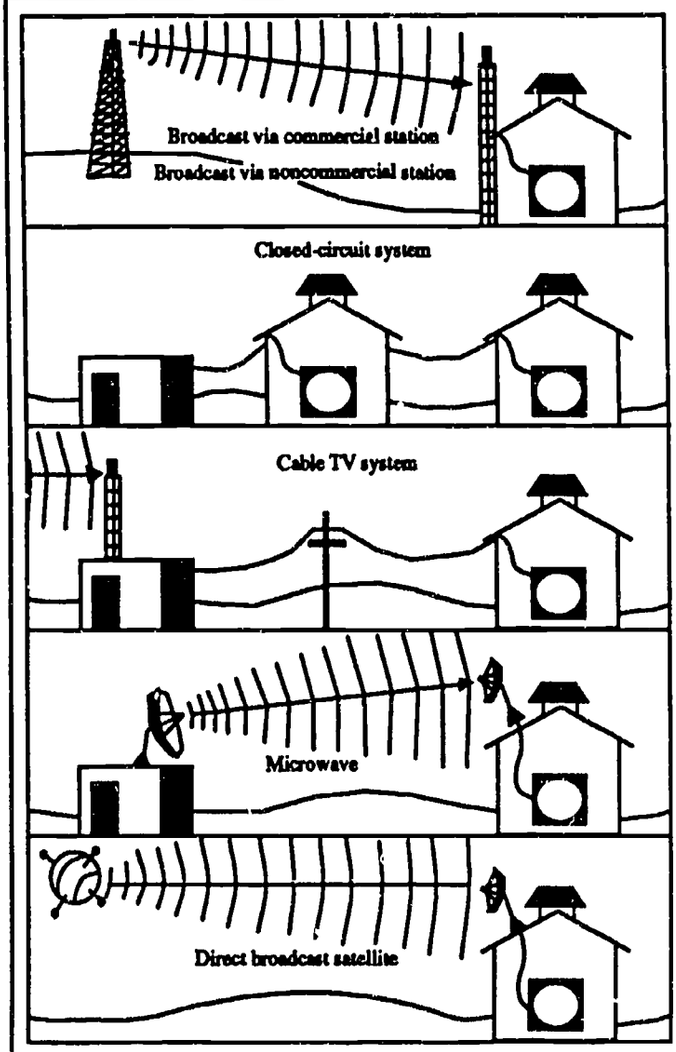
Another advantage to this sort of regional delivery is that the teacher could meet with the remote students. In Oregon, an art appreciation course was transmitted from the Oregon State University campus in Corvallis to Bend, ninety miles away, using microwave technologies. Sixty students were taking the course on the OSU campus and ten were located in the satellite classroom. Once or twice each quarter the professor travelled to Bend and originated his lecture from that location so that the students felt included and became familiar with the instructor.

A Special Microwave System

Instructional Television Fixed Services (ITFS) is a band of microwave frequencies set aside by the FCC specifically for the transmission of educational programming. ITFS allows broadcast of audio, video, and data to receiving sites within about a twenty-mile radius, essentially creating a closed-circuit television network.

Although this technology has been underutilized for many years, the current interest in telecommunications delivery has increased the number of organizations using it. Primarily it is used for educational institutions with multiple sites, or to link one institution to community sites. It is necessary for receiving sites to have a converter that changes signals to those used by a standard television set.

Figure 4. Alternative Delivery Systems



Source: Heinich and others 1989.

Cable Delivery

Cable television began in the United States in the 1950s as community antenna television (CATV). It was originally a way for remote and rural communities, unable to receive local broadcast signals, to view network television. The FCC began to require these companies to provide public, educational, and government access channels, but recent deregulation has eliminated all requirements from the cable companies.

Many educational institutions take advantage of these public access channels to deliver programming. Since over 50 percent of all homes are cable users, the audience potential is enormous, and the rural communities are perhaps most accessible. Thus far, cable access has had little opportunity to provide interaction, but even that may be changing as new technologies develop.

Optical Fiber

We routinely hear about optical fiber and its potential to revolutionize communications, including distance education. Optical fibers are finely spun silicon threads that allow the transmission of modulated light waves, instead of electrical signals, for communication. Each fiber can carry up to twenty-four television channels; this means that eight three-site connections could simultaneously share educational courses.

After an exhaustive study, Pelton concluded, "These fiber optic educational networks are well suited to be 'piggy-backed' on top of public telecommunications networks at a modest cost. Once established, such satellites or fiber optics networks can be easily increased in capacity over time as needed" (1991, p. 5).

At one time optical fiber was so expensive that it was not considered a viable option for school districts. Regional telephone companies have tried to get governmental agencies to help pay for establishing networks, since they typically do the work and rent the lines. Recently, however, the price of optical fiber has come down, and now it is possible to install it between buildings of a school district, between media centers, and so forth without an enormous outlay of capital.

Optical fiber and satellite appear to be the two most viable delivery systems for the coming distance education explosion. Is one a better choice? Each has great advantages, and they complement each other in many ways. A look at table 1 shows the relative merits of each. Pelton summed up the situation in this way: "Satellites are still best for broadcast distributions and for rural and remote access, while fiber optics are well-suited to linking centers of learning, university systems, etc." (1991, p. 5).

Table 1: Benefits of Satellites and Optical Fiber

Evaluation Criteria	*Satellites*	*Optical Fiber*
Ability to provide narrow, medium, or wideband capability	Excellent	Excellent
High quality, cost-efficient transmission	Excellent	Excellent
Ability to serve rural and remote areas; broadcast services		
Ability to create interactive networks	Excellent	Excellent

Source: Pelton 1991.

Computer-Mediated Communication

Computer-mediated communication (CMC), defined here as communication across distances using personal computers, modems, phone lines, and computer networks, has several unique characteristics. CMC provides immediate communication, access to previously unavailable communities, multiple participation in activities, and a window to the richness of our world.

Two important features stand out: CMC is essentially a medium of written discourse with the spontaneity and flexibility of spoken conversation, and it is a powerful tool for group communication and cooperative learning. In a case study of a graduate seminar that used face-to-face meetings in combination with electronic projects and communication, participants felt they had better collegial interactions, worked more cooperatively with others, and had a more substantive relationship with the professor than in other classes (Schrum 1989b).

This type of communication has the ability to provide support to distance learners. The network could be used as part of coursework, for asynchronous communication with instructors, and as a means of transferring text and graphics as one part of a teleconference. It offers data and information services, increases public access to public information, provides an open gateway to private information sources, and provides the following specific activities:

- Electronic mail (one-to-one messages) with gateway access to state library computer files, the higher education networks

- Bulletin boards (one to many messages) with conferencing and scheduling capabilities
- Publishing or input capability
- Indexing and searching utilities within databases
- Administrative utilities

These activities typically take place by using a host computer with electronic mail and conferencing software.

Enhancing Distance Learning Experiences

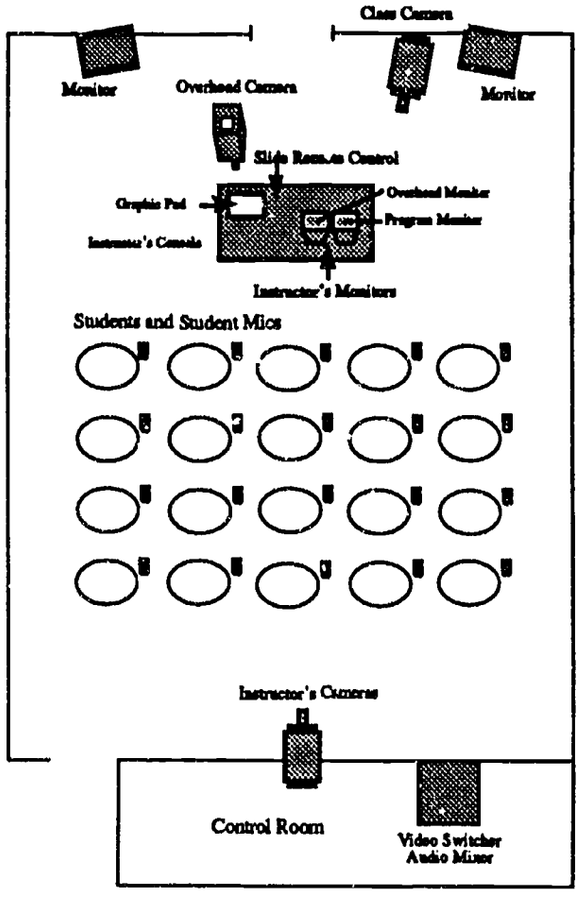
A variety of less well known, less expensive, and less dramatic electronic media have contributed greatly to the advance of distance education. Some of them may be familiar to you from other settings, but they are now firmly entrenched in this context.

Audio

Audio has provided a low-cost means of delivering distance education for many years. At one time, remote sites were able to receive courses on radio broadcast stations. With reliable and inexpensive audiotapes, this method became even more popular around the world. In Australia a "School of the Air" still delivers programming in this way.

Two types of audio technology are used more extensively. They still provide low-cost, interactive systems. First, audio-

Figure 5. Basic Distance Education Classroom



27

conferencing is reminiscent of an old party-line call. Many people can talk and listen to one another, regardless of their geographic locations. An audio bridge now assists in accomplishing this audioconference. The bridge is an electronic device that connects and controls multiple telephone lines for audio and data. Many callers can be connected as a group simultaneously. The cost for audioconferences has been reduced substantially with the addition of audio bridges.

The second audio technology is audiographics. This technology is a telephone-based system allowing simultaneous transmission of voice communication and graphic images across local telephone lines. This interactive medium permits users to speak with one another, share text and graphics, and observe the same materials on monitors. The monitor is described as an "electronic blackboard" because it functions like a conventional blackboard. Some of these systems can print a copy of a screen, which can then be faxed to other sites. Two phone lines are necessary, and multiple sites can be bridged together for communication. Audiographics has been used with large and small groups, predominantly in rural locations and with field-based educational programs.

Facsimile Machines

Most of us are familiar with a fax machine. It certainly has changed the ways in which we communicate with others. This system is a telecopying machine that sends written or graphic material over telephone lines to produce a "hard copy." In distance learning, the use of a fax machine makes it possible to instantly send tests, correct inaccurate perceptions, and improve communication between the teacher and the remote students.

Electronic Blackboard

An electronic blackboard can also enhance the quality of distant classes or teleconferences. With this instrument one person can write upon a familiar looking "blackboard," and everyone watching can see the diagram. Someone at a remote site can also write on a similar piece of equipment, and his or her additions to the diagram appear on the first blackboard so that others can see the new picture. Some electronic blackboards have an additional feature—they produce a hard copy of the drawing that can be faxed to all participants.

Graphics Tablet

A graphics tablet works on the same principle as an electronic blackboard, except that it is smaller and can be connected to a computer. Like an electronic blackboard, the final product of a group discussion and creation

can be seen by all participants, discussed, and faxed to everyone. Some teleconferences take place with only an audio bridge and a graphics tablet; this provides the essential interaction but at a fraction of the cost of a satellite transmission of video.

Another version of this is the interactive keypad, which resembles a calculator with an antenna. Students transmit their answers over telephone lines, so that the teacher is able to evaluate student performance immediately.

Videophone (Lumaphone)

I recall a time when science fiction predicted the invention of a telephone that would allow the caller and the person being called to hear and see each other. This fantasy has become reality. Although still relatively expensive, these phones are available to the general public. They require two telephone lines, one for the video and one for the voice, and they do provide a recognizable image of your telephone partner.

As the price comes down and the picture quality improves, the use of this technology will enhance all distance education. Using a satellite transmission and one-way video, students in remote classes could see each other and teachers could see at least one student at a time. The lumaphone already has been used to connect distant partners in computer-mediated activities so that the individuals have the opportunity to meet each other.

Summary

Although many technologies were described in this chapter, a final decision about which technology to use may seem no closer. However, it is important to have background information about the available choices when describing their potential educational applications. Before beginning those descriptions, it is important to ask if distance education is good education. Therefore, chapter 3 describes what research has to say about this form of educational delivery.

Chapter 3

What Does Research Tell Us?

Distance learning affects the educational process in a variety of ways and in different ways for individual learners. As school districts make decisions regarding distance education and consider various methods of delivering courses to their students, their constituents have a right to know if distance education is an effective method of instruction. It is prudent, therefore, to look at the research to inform those decisions.

This chapter offers the results of research in distance education. The first part of the chapter describes research specifically related to student populations, courses, and media. Research on computer-mediated communication, which also has potential for distance delivery throughout K-12 education, is discusssed in the second part of the chapter.

Research in Distance Education

Whereas in the industrial age people went to school, in the information age school is beginning to come to people. Distance education is an emerging phenomenon that is still trying to define and establish itself as an important component of the academic community. During the last twenty-five years research has been haphazardly applied to distance education courses. The bulk of research consists of statistical studies of student populations and a few qualitative studies on students taking distance education courses.

The reality of distance has often dictated the methods of research and evaluation within distance education programs. In many studies, survey questionnaires were sent through the mail to participants. Such surveys usually incorporate closed-ended questions, with the range of response options predetermined by the researcher (Morgan 1984). This method of data collection has been used to determine dropout rates, describe students and their situations, and learn about their preferences. The empirical re-

search has also focused on comparisons of a variety of media used for delivery of instruction. Morgan (1984) urged that more qualitative research methods be employed in the study of distance education. Recently there has been a trend in this direction, as research has begun to explore course development as a whole.

Millions of people around the world are involved in distance education. Therefore, much of the research has focused on the consumers of distance education programs. The aim of distance education is to engage students in effective learning to attain specified objectives. The research on students falls into two categories: student profiles and students' reasons for persistence or attrition.

Student Profiles

Various studies have been conducted, usually through questionnaires and occasionally by interviews, to develop profiles of students who complete distance education classes. Students who learn at a distance cannot be regarded as homogeneous; however, there are certain common factors that have been identified by distance education research. Generally, students who enroll in distance education courses identify themselves as being highly motivated, having degree and certification goals, and enjoying individualized pacing (Flinck 1979, cited in Holmberg 1988; Glatter and Wedell 1971; McIntosh and Morrison 1983).

Persistence and Attrition

Providers of distance education courses have identified students' lack of persistence in completing courses as the major concern for their institutions. The issue of dropouts is of considerable importance from an institutional perspective, as many distance education students fail to complete the goals they set for themselves. This is considered by some to be the most significant criterion for decisions about improvements or changes to systems of distance education (Rekkedal 1978).

Although most K-12 students do not have the option of dropping a course once it has begun, we can learn about what constitutes a good course; which students are most likely to be successful in distance education; and how to prevent negative experiences for students, parents, and faculty.

Factors shared by successful distance education students include motivation, internal and external reward, and learning autonomy. The great majority of adult distance learners are between twenty and forty years old and are studying at home on a part-time basis while maintaining full-time jobs. Lack of student persistence is a continuing concern, but it appears that student course completion rates are improving. Research has begun to focus

on the support systems that provide students with help beyond the course materials.

Which Media for Distance Education?

The last chapter described many different technological advances in distance education. Is one best? Probably not. There is little evidence indicating that any one form of technology surpasses the others in accomplishing all the goals of distance education. In an extensive review of the research on distance delivery systems, McClelland and Saeed (1986) found no substantive differences in achievement or cost effectiveness among the various media. They suggested that for distance education, it is first important to reconceptualize instruction and to focus the research on instructional design, learning tasks, and the learner. Herschback (1984) came to a similar conclusion, stating that studies indicate little or no difference in learner outcomes when various media are compared.

There is little agreement on the best way to deliver instruction at a distance, for, as Salomon states, "each technology has its unique strengths, such as television reaching a large audience and computers permitting students to control their own learning" (1974, p. 25). Further, Schramm argues that learning materials can be transmitted through any medium (1972). What is apparent from the research is that course designers need to identify what their goals are, what their students' needs are, and what technology is available and cost-efficient, then move to develop a match within this framework.

Table 2 indicates the relative cost and level of interaction among various media and appropriate uses for each medium.

Support for Independent Learners

Support for students and faculty is especially critical in distance education. Research has been conducted to determine the needs of the students and to further identify the types of support that are most helpful.

In a survey of 240 school districts, Threlkeld (1990) asked respondents to rank order attributes and support features of distance education courses. He found the following as most important to them: library resources available on site, ability to talk to instructor during the televised class, ability to talk to instructor before or after the televised class, having a certified person in the classroom with the students watching the class, having other media to support the instruction, and having live instruction instead of tapes. The unexpected finding was the low ranking of live instruction and the high ranking of library access (p. 16-17).

After nearly ten years of offering telecourses, the state of Alaska

Table 2: Comparison of Distance Education Media

Media	*Interaction*	*Cost*	*Appropriate for*
Satellite or microwave	High	High startup	High school courses when not available to students
Computer communication	High	Low	Text-based courses, support for interactive courses, followup, student-to-student exchanges
Broadcast radio or video	None typically	Low	Lecture format courses, discussions by experts
Teleconferences	High	High	Single purpose, short-term, multiple locations
Fax	High	Low	Support for other technologies; graphic-based material exchange

investigated problems that interfere with thorough utilization. In interviews with teachers, administrators, and staff, most people named the following factors as contributing to their use of the system: ease of teacher/student control and use, high reliability and low maintenance, and flexible interaction—"the most critical factor by far" (Willis 1989, p. 33).

In one study of teleconferencing for staff development, participants were interviewed in a series of urban and rural workshops and then offered suggestions and guidelines to help others make effective use of this technology (Fennimore, Donnelly, and Jones 1988) They recommend adequate rehearsal time, publicity, onsite coordinators, group activities, and followup as necessary components for successful teleconferences.

For K-12 students, research suggests that the following elements are necessary: adequate staff support for the introduction of distance education programs, careful scrutiny of program providers, and input into course development.

How Effective Is Distance Education?

Some distance education researchers have examined the development and effectiveness of distance education courses as a whole. However, re-

searchers disagree about the best way to frame the questions to be addressed. Much of the research has focused on comparing distance education with traditional education, and this has led to research designs that look at one course delivered in two or more ways. Put another way, one question frequently posed is, "Is distance education a unique form of education in its own right or is it merely a substitute for conventional education?"

Smith's (1984) research review led her to conclude, "Despite study-to-study variation, the literature surveys have generally agreed on one basic conclusion: other factors being equal, telecourses are at least as good as traditional on-campus lecture-format courses" (p. 94). Schramm, after reviewing data from projects in countries around the world, summed up the debate:

> The import of this rather impressive evidence is that distant teaching, well-conceived, well-supported with the proper media, really works. It works in developing countries or in highly industrialized ones, and at many different levels of education. Where data are available, they appear to show that students in these media-extended programs learn at least as well as students in the same curriculum in traditional classrooms. (1977, p. 135)

Holmberg (1988) has summarized the research by stating that it identifies students and their circumstances, needs, and wishes, and examines the study process and courses. He found that less attention has been paid to effectiveness and economics, teaching and learning, and relevance to the individual and society.

Research has been done by network providers of programming, or by individuals working with one network. In addition to raising the issue of researcher bias, it is important to wonder about the populations of learners. Usually, advanced courses are the ones offered, and the students are the ones who would typically be expected to have positive educational outcomes. Bruce Barker (1987), who has completed several studies on the TI-IN system, found that students and principals had favorable responses to the interactive courses but would prefer classroom instruction if it were available. In a study of teacher effectiveness, he found that quality instruction can occur using interactive satellite teaching, but that the medium reduces teachers'ability to gauge and adjust for student responses and allows some students to participate minimally (Barker and Patrick 1989).

This review of findings in the preparation, delivery, and support for distant learning classes leads to several conclusions. Each student who signs up for distance education courses begins with personal requirements and motivations. The research also suggests that no single form of delivery is best for all courses or all students. The field of distance education is still emerging and struggling to define and establish itself. During the last

twenty-five years, research has been haphazardly applied to distance education courses. The reports have tended to focus on statistical studies of student bodies and qualitative studies of the conditions of students.

This has importance for the K-12 districts. If an institution is to assist in successful completion of distance education coursework, then more than the one hour a day in class needs to be considered. Questions to ask include:

> Is each student and family aware of the requirements necessary to take the course? For example, will someone need to drive the student to class at 6:45 every day, or will the student miss part of one class due to scheduling conflicts?
>
> Is each student provided help in learning the mechanics of the technology or in sending materials to the distance education network?
>
> Is there one faculty member responsible for working with the distance education network? One study found that having only one person as intermediary between the home school and the distance school rapidly smoothed out problems.
>
> Have guidelines been established to resolve a dispute? Does your school have a voice in the grading practices, or are they based on national rules without taking local culture into account?

Computer-Mediated Communication Research

Computer-mediated communication (CMC), which uses computers, modems, and telephone lines, has only recently been added to the list of technologies available for distance education. The nature and attributes of this medium seem to combine features of place-based education (notably group interactivity) and of distance education (notably the freedom from time and place constraints). Two important features stand out:

1. It is essentially a medium of written discourse, which shares some of the spontaneity and flexibility of spoken conversation.
2. It can be used as a powerful tool for group communication and for cooperative learning.

CMC has great potential for distance education; juxtaposition of ideas and information from multiple participants, facilitation of open discourse, and globalization of education are all within the realm of possibilities. Most research has concentrated on two areas, providing support for current distance education courses and introducing innovative ways of teaching.

Support for Current Distance Education

Hart (1989) describes the use of CMC as an addition to distance education courses in Canada. Reports from the students support his belief that the interaction, immediate feedback, and instructor access improve participant satisfaction. In early trials, Kaye (1987) found electronic mail and computer conferencing enhanced student learning. He also found that, to be effective, tutors needed to have some training in moderating the conferences.

Some evidence suggests that the introduction of computer conferencing into dispersed groups may lead to an increase in other forms of communication among some of those involved (Kerr and Hiltz 1982). Phillips and Santoro (1989) concluded that CMC was a remarkably positive addition to a class in problem solving. Four advantages stood out: CMC was an efficient device for gathering data about group operations, shy students were not at a disadvantage, students could argue without becoming overly emotional, and storage and retrieval were facilitated. It appears that CMC offers benefits to traditional distance education.

Initial studies on this use of CMC were carried out by the Open University. Kaye (1989) feels the use of the technology will spread to other countries and universities. He believes that a record of information permanently available, immediate feedback, databases developed cooperatively, and the asynchronous nature of the interaction will encourage others to experiment with CMC.

Innovations in Education

The second major use of CMC is to accomplish educational goals that have never been considered, simply because they were logistically impossible. These include online courses, classes that combine face-to-face meetings with computer interactions, communications between geographically separated groups, and student-to-student curriculum interactions.

Hiltz (1986) researched the effects of an online course at the New Jersey Institute of Technology. The course lasted three months and was a "laboratory without walls," designed to develop and assess various structures for computer-mediated communication. The results show that the majority of students thought they had a better learning experience, less inhibitions, and better access to colleagues and instructors.

As a supplement to current educational practices, CMC has been used in many ways. Harris (1989) reports a three-year project linking student teachers with their supervisors and master teachers, as well as with each other. Participants reported deriving support and satisfaction from these interactions.

Another project that addresses the needs of teachers is taking place at Harvard University Graduate School of Education (Rodman 1989). New teachers can get help and support from other first-year teachers and faculty. One teacher sent out a plea for help with a difficult student and within hours received practical advice and moral support. Interviews with the participants have given overwhelming support for this type of system. This project and the Harris study will be detailed in the following chapter.

At Arizona State University, a professor offered a weekly face-to-face doctoral seminar in combination with electronic projects, statistics, and communication. In a case study of the first semester of this class, Schrum (1989b) found that most students felt they had better collegial interactions, worked more cooperatively with others, and had a more substantive relationship with the professor than in other doctoral classes.

Student projects that use CMC, as well as other media, are linking classes to exchange ideas and plan projects together. One example linked two schools in Argentina with two in the U.S. (Sterling 1988). In a discussion that included geography, history, natural resources, and the landscape, children discovered they had much in common. The final activity had the students prepare a bilingual newsletter that was sent via satellite to the other classes. In interviews, students and teachers praised the project for the interaction, sharing, writing, and cultural understanding that it promoted.

Banks Street College designed a research project to explore ways of teaching science. The curriculum and research coordinators looked at whether access to networks would encourage teachers to assign more collaborative projects and could help integrate science into the general curriculum (Brienne and Goldman 1989). "Earth Lab" was field tested with sixth graders and included one unit on weather and one about plate tectonics. Reports about the units from teachers and students reflect a sense of empowerment in gaining access to real-world data, predicting where and when a storm system would arrive, "inventing" the theory of continental drift, and writing about their experiences.

It is premature to try to summarize the research on CMC, as most of the reports are formative. Only in the last few years has any information been available regarding the uses of this technology. Currently the Office of Technology Assessment estimates that only 7 percent of educators in the United States have tried using CMC, and that figure is probably lower for other countries (U.S. Congress 1988). The limited research that is available appears to lend support to the positive descriptive reports.

Summary

Regardless of the research, distance education has been growing and

will continue to do so. Distance education delivery systems ask organizations, schools, and individual teachers to change the ways in which they have taught, administered programs, and communicated with colleagues and peers in complex relationships. Time needs to be spent studying ways of assisting teachers and administrators to examine, weigh, and select new ways of doing familiar things.

The next chapter presents a wide angle view of demonstration projects, programs, and courses that deliver education in a variety of nontraditional ways.

Chapter 4

Putting Distance Education into Practice

"I am nervous about the SAT and I think this will be better, will help me to be calm about it," said Leslie, a student at McKenzie High School. Three students and the high school counselor gathered around a large screen monitor in a small prefabricated building at the rural school in Blue River, Oregon, on a rainy Saturday morning. These four individuals volunteered to participate in a Scholastic Aptitude Test preparation program delivered over satellite on Oregon's ED-NET system. This program would not have been available to them any other way.

Blue River is a small town with a population of fewer than 1,000. About twenty-five students graduate from the high school each year; of these, approximately 50 percent attend some type of postsecondary institution. The district and community are committed to education, especially to providing local students with opportunities to use advanced technologies. Led by the superintendent, the district has encouraged and funded distance education because "it will expand all sorts of opportunities for students" (Carlson, September 1990, p. 27). Last year the district joined Satellite Telecommunications Educational Programming (STEP) and contracted with them to offer courses in Japanese, Spanish II, French, Russian, calculus, and psychology/sociology.

The students were interviewed about their impressions of distance education courses in general. One responded,

> This is harder, and courses are harder, because there is no real interaction with the teacher, and the people calling in interrupt the lecture and discussions. The facilitator is helpful, but she is not a teacher. I have not talked about the courses I have taken or this (SAT) with my parents, so I don't know what they think about distance education. (Schrum 1991b)

These students and others have had the chance to interact using new technologies, but the most important aspect for many students is that "we would not have a way to learn about this any other way." Many recipients of interactive distance education courses are in a similar situation.

Satellite Delivery of Courses

Reports of student use of distance education, especially in high schools, often focus on the most advanced courses and subjects delivered to the most motivated students. Many distance delivery systems advertise their Russian or calculus classes, and the media concentrate on these activities, too. McKenzie High School has successfully integrated advanced courses into their curriculum, although it had typical difficulties with scheduling and budgets.

Delivery of advanced courses is certainly an appropriate use for the technology and offers opportunities to those who might otherwise not receive the education they need, but this is not the only possible application. Other uses have been designed and are being evaluated in a variety of settings. For example, a group of faculty decided to experiment with exposing middle school students to marine science. A course for delivery over satellite was developed by a high school science teacher using slides, video clips, and footage from the Marine Science and Oceanography Center in Newport, Oregon. The course has proved exceptionally popular with students in eastern Oregon, who live far from the ocean. Twice during the pilot year students and their families raised money to fund weekend retreats at the Newport center. The students, faculty, and others involved rated the course and the onsite visits a tremendous success (Schrum 1991a).

In Minnesota, local districts, regional consortia, and the private sector collaborated to assist suburban and rural areas by providing exemplary courses. For example, social studies teachers in Edina have provided classes to students in Richfield and St. Louis Park via interactive television for many years. The technology, once in place, has also been used for town meetings and community development. In one example, a teleconference in Eagle Bend, Minnesota, focused on "The Future of Education" and involved the entire community (Randall 1991).

Satellite and microwave delivery of course work is being tried in many settings. The Arizona State University has an ITFS system in place that broadcasts four channels of programming to remote sites throughout metropolitan Phoenix. Using underground fiber optical links and microwave transmitters, the entire area is covered by the system. The remote classrooms are located at industrial plants and one branch campus, with plans under way

to extend to another branch campus. Although at this time they do not have plans to extend this service to high school classes, it is possible that will happen in the future (Wagner and Craft 1988).

One final example further illustrates that distance education can be put to a number of creative uses. The Bristol Cathedral School in England uses a satellite dish to access French, German, Italian, and Spanish language television so that students can hear native speakers in these languages and achieve fluency in a shorter time. Faculty have been encouraged by the positive results.

Satellite Delivery of Inservice Education

We hear a lot about delivery of high school or postsecondary credit courses, but satellites and microwave technology also provide inservice and updated training not previously possible. AIDS training for medical personnel in rural locations, demonstration of proper use of new fire equipment and technology to volunteer firefighters, and national development courses in Africa are only a sampling of current applications. In addition to these uses, interactive distance education has been used in teacher preparation and professional development. The following examples demonstrate current uses.

Iowa State University

Exposing teachers in training to good teaching has been one of the most difficult challenges of teacher preparation. Typically, student interns have the opportunity to observe only five or six master teachers. Iowa State University has a unique program that allows student teachers to become competent observers of teaching and learning environments and provides a diversity of high quality introductory experiences of exemplary teaching in diverse classrooms.

Now in its fifth year, Teachers on Television (TOT) chooses teachers who represent diversity in grade level, teaching style, and educational philosophy. Prior to each broadcast, the participating teacher supplies information about the instructional setting. An ISU education faculty member bridges education theory with actual teaching practice. At the end of the broadcast a followup interview with the teacher allows for discussion, identification of successes and problems, and future plans (U. S. Congress 1989).

Staff Development via Satellite

A number of states are currently delivering professional development programs via satellite. In rural areas teachers may not have easy access to

graduate courses, recertification classes, or updates for regional or national mandates (special education or talented and gifted programs, for example). With satellite transmissions, however, geographic isolation is no longer synonymous with educational isolation. In addition, teachers around the country are now able to learn from recognized experts in specific fields at reasonable costs.

In 1987 Alaska began an extensive distance education project called Learn Alaska. Part of the project focused on professional development for educators using video and audio transmissions. One program featured an internationally known "Art Maker," Dan Mihuta, describing techniques for art instruction in elementary schools. Another program provided instruction on the use of drama in counseling teenage students (Bramble 1988).

This technology is not only useful in rural areas. In Los Angeles, where a drive across the city can take up to two hours, the Los Angeles County Office of Education provides staff development via satellite. Programming is provided at no charge to sixty-two school districts in the county and twenty-five others around the state. The largest use of the system has been for staff development telecasts in curriculum reform. Programs are live and interactive; viewers are able to call in their questions and comments. Many programs allow participants at local sites to discuss ideas and then share their questions and ideas with the presenters and other groups.

Computer-Mediated Communications

> "I'm in dire need of help! At this point I feel like one of those teachers I always said shouldn't be teaching," said the first year teacher. Anita Houck asked for help from colleagues, but not on the telephone or in the teachers' lounge. She sent an electronic message to former classmates and instructors around the country. Within hours of sending this SOS, Houck received help in the form of practical advice and moral support. "I was really lost. The emotional support I got back helped." (Rodman 1989, p. 33)

The above incident took place on an electronic bulletin board in one of several experiments to better prepare and support new teachers. Computer-mediated communication (CMC) provides immediate communication, access to previously unavailable communities, multiple participation in activities, and a window to the richness of our world.

Two important features characterize CMC: it is essentially a medium of written discourse with the spontaneity and flexibility of spoken conversation, and it is a powerful tool for group communication and cooperative learning. In a case study of a graduate seminar that used face-to-face meet-

ings in combination with electronic projects and communication, participants felt they had better collegial interactions, worked more cooperatively with others, and had a more substantive relationship with the professor than in other classes (Schrum 1989b). Here are three examples of activities in preservice teacher education.

Curry School of Education

The Curry School of Education at the University of Virginia created Teacher-LINK, an electronic bulletin board system to connect student teachers in the field with their university professors. Students, who are given an account on the network when they enter the program, are able to communicate with professors, colleagues, and classroom teachers. The originators of the program hope that "by graduation, they will use the network as fluently as the blackboard and become the first generation of teachers trained to use an extended academic community as an instructional resource" (U. S. Congress 1989, p. 13).

This project began with an equipment grant from IBM, software donations, and support from the local telephone service. Operating costs have been shared by local school systems and the Curry School of Education. Students and faculty have exchanged lesson plans, obtained support from peers, provided feedback and clarification, scheduled meetings, and shared curriculum ideas.

Harvard School of Education

Harvard University's Graduate School of Education also began a project that addresses the needs of teachers (Rodman 1989). Beginning teachers are usually far away from the support and wisdom of trusted colleagues and instructors, which is probably one reason 15 percent leave teaching after the first year. Katherine Merseth, former director of teacher preparation at Harvard, came up with a unique idea. Using a personal computer and modem, the neophytes get help and support from faculty and other first-year teachers. With a grant, Merseth launched the project in 1987, and in the first two years, approximately 90 participants transmitted more than 7,500 messages.

This network also helped former students continue discussions about education issues, theory, and policy that had become so much a part of their lives at the university. Based on feedback from dozens of Harvard graduates, Merseth is certain she is "on to something." She believes "this is a coming thing." Mary Driscoll, a teacher in a Boston alternative school, said, "Being on the network helped me keep a sense of the bigger picture and what the whole endeavor of education is all about" (Rodman 1989, p. 34).

CMC is also being used in teacher development and enhancement. The International Society for Technology in Education (ISTE) is offering an independent study course, Telecommunications and Information Access for Educators. Participants exchange electronic mail, interact using computer conferencing, search remote databases, and practice integrating curricular activities using telecommunications. This course is offered entirely online, which speeds turnaround time for assignments and increases the student/ instructor interaction. Educators earn four graduate credits from the Oregon State System of Higher Education while learning the technologies they will need for the future.

Classroom Uses of Information Technologies

Once teachers are comfortable with these emerging technologies, many uses are possible. The technologies provide unique opportunities to meet educational goals, enhance personal and professional development, and diminish teacher isolation. All levels of education—universities, K-12, and continuing education—can now be electronically linked to each other and to informal learning institutions such as museums and public libraries. Teachers can arrange for their students to interact with classes around the world, investigate remote sources of information, and facilitate the process of democratization as groups exchange information equally. Students learn to recognize the similarities among all citizens and to celebrate each culture's unique aspects.

Teachers have begun to set educational goals that were not possible prior to electronic communications. New goals related to all curricular areas are being set, but the writing process, which underlies and supports most academic endeavors, may be particularly affected by changing technology. Recent research has validated teachers' long-held belief that students write more carefully, edit their work, and plan more extensively when they are communicating with an audience of peers (Anderson-Inman 1990, Riel 1990).

Projects reported in educational journals reflect this diversity:

- Puerto Rico and San Diego classes participated in bilingual education projects (Sayers and Brown 1987).
- Australian-American connections shared national information and planned a joint Halloween party (Butler and Jobe 1987).
- Sixteen countries produced a water collection and usage survey (Schrum 1989a).
- Tokyo and San Diego university students discussed serious issues

about suicide, peaceful alternatives to war, and water supply systems (Riel 1987).

Database and Information Access

One of the most exciting areas of distance learning occurs when students can access information from remote databases and collections. The Chicago Public Library, for example, is available online. Many state libraries make their card catalogs available at no charge. A variety of commercial networks offer database services to schools (see Appendix B). More importantly, however, are projects that assist teachers and students in using these information rich resources.

The Minnesota Department of Health and the University of Minnesota Adolescent Health Program were awarded a federal grant to develop a model adolescent health database. A large-scale adolescent health survey was completed in 1986-87 to gather comprehensive information from 36,000 teens. The survey focused on such topics as major worries and concerns of youth, body image, nutrition and eating behavior, sexual behavior and orientation, mental health, risk-taking behaviors, school perfor- nce and conduct, substance use, and relationships with family and friends.

The results yield rich information about attitudes, trends, and teens' health-related knowledge and practices. This database, used by state agencies and administrators, was not meaningful or readily accessible to a significant segment of the educational system—the students and the teachers. Therefore, the Minnesota State Planning Agency decided to generate interest in the information by facilitating teacher discussions and by encouraging student involvement with the issues.

A six-week pilot study was conducted to give teachers and students an opportunity to explore, discuss, and utilize the information in the database. In addition, it was hoped that this would produce feedback about their ongoing concerns. An electronic conference was created on a public educational network to explore these topics.

This pilot telecommunications project was designed to give teachers information, provide a forum to discuss the issues, and encourage dialogue within each class. The project supported teachers' discussions, encouraged investigation of pertinent data, and engaged adolescents in meaningful dialogue with peers. It simultaneously met educational, social, and community goals.

The results were encouraging. Teachers interacted in many ways and reported increased confidence in discussing these subjects. Some student and teacher questions were forwarded to experts at the University of Minnesota

Adolescent Health Center. Students in other locations decided to administer their own surveys so they could compare the results in their school with the results in Minnesota (Schrum 1990).

Summary

This chapter has presented examples of secondary and middle school uses of distance education technologies to meet diverse needs of learners in a variety of settings. It mentioned innovative ways in which preservice and inservice activities are enhanced through distance education technology. Finally, efforts to use computer-mediated communication to provide teachers and students with previously unavailable opportunities were described. Next, in the final chapter, some administrative concerns will be identified and suggestions offered for implementating distance education.

Chapter 5

Administrative Concerns

This chapter pulls together what we know about implementation of distance education and identifies the benefits and problems that may result from initiating it. Once a district has identified reasons for utilizing distance education, three major areas must be addressed: (1) financial considerations, (2) logistical concerns, and (3) implementation issues.

Financial Considerations

Whether we like it or not, the decision to add a new educational activity is frequently based on financial considerations. To provide a realistic picture of the financial commitment required to become involved in distance education, sample costs for several different types of distance education are mentioned in this section.

It is helpful to consider two basic types of expenditures that are involved in providing distance education. First there are initial costs, which include transmitting and receiving equipment. Then there are continuing costs for such things as programming and operation. Costs will vary greatly between schools that only receive programming and those that both originate and receive. These are only rough estimates, of course, and should be thought of as ballpark figures for schools with no extenuating circumstances.

Satellite Delivery

Satellite delivery will be mentioned first, since it is a relatively accessible and common way for schools to become involved. The TI-IN network is a good example. Let us assume that your school has no equipment and you decide to install the equipment necessary to join TI-IN.

First, the district must purchase a receiver dish and have it installed. This price varies depending on the size of the dish, whether it is steerable (to

make the fine tuning easier), and whether it receives only one band or both C/KU bands. According to the U.S. Congress, a C-band receive-only downlink costs between $5,000 and $10,000, and a C/Ku-band receive-only downlink costs about $8,000. It is also necessary to pay for installation, cabling, securing the dish, and other items. The subscriber interface device, which includes the push-to-talk telephone, is $1,200, and a dedicated phone line must also be installed (U. S. Congress 1989, p. 172).

These initial costs are entry-level expenses. Next, districts must pay for programming and continued support for courses. Table 3 estimates the cost for two years of very modest course offerings.

Table 3: Sample Expenses for Two Years of Programming

Item	*Extension*	*Cost*
Yearly fee $3,500	2 years	$7,000
Phone line $50 per month, plus installation	2 years	$1,400
Spanish and Chemistry for 20 students	$580 per year per student, for 2 years	$23,000
Art History for 12 students	$480 per year per student, for 2 years	$11,500
Total for 32 students for 3 courses for 2 years		$43,100

One might look at the almost $44,000 in costs and decide that distance education could replace one teacher, avoid benefits, and provide excellent teaching for students. However, other charges are not listed in this chart. A facilitator must be provided for each classroom for each period, and frequently it is necessary for that person to be a certified teacher. Other possible expenses include laboratory equipment for science labs, equipment repair, and security and maintenance costs.

For this particular network, some schools are able to access the courses using cable connections. If your school is wired for cable, you might wish to contact the local provider and ask if they have connections to the TI-IN network. Sometimes they are willing to assist schools by adding this to their programming repertoire.

Other Distance Technologies

How do other technologies compare with satellite delivery? Cable is

used frequently in schools, but often there is only one cable drop at a location. Complete internal wiring can be very expensive. For example, the Dallas Independent School District decided to wire all classrooms in 235 schools with cable and telephone lines at a cost of $3.8 million, which will provide multiple options for instructional delivery (U.S. Congress 1989, p. 173). There are also ongoing operational costs and maintenance budget items.

Microwave systems can also be expensive. Duplex microwave systems can cost between $40,000 and $65,000 per channel, including transmitters, receivers, and all electronics. Towers requiring longer distance span can cost more. Adding additional channels can cost almost as much (U.S. Congress 1989, p. 173).

Computer-based operations require a smaller initial monetary investment:

Personal Computer (any type)	$1,000 - 3,500
Modem	175
Graphics Tablets	400
Scanner	1,300
Printer	300 - 1,500
Communication Software	0 - 3,500

Total costs vary greatly but are under $10,000

Source: U.S. Congress (1989)

Ongoing costs for computer-mediated communication include network access, phone lines, and wiring, if necessary.

Fiber optics, whether purchased by the district and constructed to district specifications or leased from a national company, are expensive. Prices tend to be regionally determined so it is not feasible to give even general amounts. As a sample, however, in Dodge Center, Minnesota, the district leased a sixty-plus-mile network with a seven-year lease. The cost is $53 per mile per month including all maintenance. That works out to approximately $38,000 per year. The expenses for fiber optics are dropping all the time, and this trend is not expected to change in the near future.

Funding to Support Distance Education

Money is not easy to find these days, particularly in education. Yet it is possible to garner support for initiation of technological projects, including equipment, programming, and research. Federal, state, and local organizations are all possibile sources of revenue, especially in rural areas or for

districts with large at-risk populations.

State organizations often award small grants, and frequently their application process is much less cumbersome. Local education and community groups often have small amounts of money to donate to a variety of activities. This type of project also is an excellent opportunity to build partnerships with local industry and businesses.

Local telephone companies often provide money or equipment for telecommunications projects. Charles Johnson, of Southwestern Texas University, wanted to connect youngsters in his community with others around the world. He had graduate students willing to assist in the learning process but needed equipment and support. "I was able to get our local telephone company to donate two Macintoshes and the high speed (9600 baud) lines to connect them to our university VAX. I also was able to get our university to donate a 'guest' account for the 6th grade class to use" (Personal electronic communication, March 1991).

Articles in local newspapers also sometimes generate business involvement. An example occurred in California, where a class of students had been exchanging letters with students in the Soviet Union but could not afford to continue the project the next year. An article describing the successful exchange and the impending termination of the program due to lack of funding produced two local businesses willing to fund the activity for the following year.

Partnerships could also include a local university. Universities offer a wealth of technical expertise and are often willing to provide research support without charging consulting fees. In Westport, Connecticut, the schools are benefiting from such a partnership. Xerox Corporation is providing funds and technical help, while Lehigh University staged a technology fair and trained eighteen teachers to pursue technology projects (Ward 1988).

Frequently states provide extra funding for rural and high impact areas to ensure equal access to technology, courses, and potential skill development. Some funding is creative. For example, Missouri adds a small tax to each video that is rented, and the money raised goes to pay for distance education throughout the state. It may be beneficial to contact your state department of education to discover what situation exists in your area and what options are available.

Logistical Issues

In a study of thirty-six interactive classes and thirty-six traditional classes, participants at the most successful interactive sites agreed that an established set of policies and procedures was the most significant need in

beginning a program (Randall and Valdez 1988, p. 378). The following areas should be addressed when establishing procedures that are equitable, reasonable, and considerate of all involved.

• *Timing and scheduling*. School calendars, hours of programming, and teacher monitors were all areas that needed to be addressed prior to initiating distance delivery. Technical failures, for example, could result in many students having no place to go or nothing to do. Details such as materials arriving on time, tests being monitored and mailed or faxed to the originating teacher, and defining discipline procedures all should be made clear to faculty, students, and parents.

• *Union concerns*. One of the major concerns voiced by teacher representatives is the fear that faculty will lose jobs to distant teachers. Seldom are teachers replaced; usually a distant teacher is used when a qualified person cannot be found to teach a course. Interstate delivery of courses by teachers not certified in a particular state has created difficulty in many states. In Oregon, for example, an agreement was reached in which teachers must be certified in the state from which they broadcast and must also pass one of two Oregon-mandated national education examinations (Piele 1989).

Another concern is for the qualification of the facilitator. Some courses require a certified person be in the room, while others do not. The individuals hired to staff the interactive room during classtime, however, might be required to have some knowledge of the subject matter. These issues need to be addressed in open negotiations so that everyone is comfortable with the outcome.

• *Which programs for which students*. Should all students be allowed to enroll in distance education courses or should there be some guidelines for entry into the system? Some districts require students to get recommendations from two teachers and a parent. Clearly, some students will benefit more than others from independent learning activities. On the other hand, is it reasonable to eliminate students who have an earnest desire to tackle a particular course?

Other policy issues arise as the courses get under way. It is wise to have a committee in place to deal with problems as they occur. Making a decision that will need to be modified later is better than making no decision at all.

Implementation Issues

The superintendent of a small district decided that distance education would be the perfect answer to the dwindling population combined with increased educational expectations. Some students were no longer able to

receive the courses they needed to go on to college; the community had a large number of displaced workers who might be able to take advantage of equipment located in school facilities to upgrade their skills; and many students were unable to take community college articulation classes because the travel time to get to the college interferred with their afterschool employment.

He had excellent reasons for proposing distance education. Unfortunately, he was ultimately forced to cancel all the plans because his board, administrative support personnel, principals, and faculty had not been included in the planning and refused to participate in the project.

We know from the literature on innovation, change, and implementation that most new technologies in education are not easily accepted. Further, the average length of time for new technology to be adopted by schools ranges from twenty years to forever (Berman and McLaughlin 1977, Cuban 1986, Fullan 1982, Schrum 1991b). Once distance learning is being considered by a school district, the entire educational community, including teachers and administrators, must be part of the process.

Perhaps one of the better ways to increase the likelihood that the new technology will be supported and encouraged is to stress that inservice training will be delivered by distance education and available for credit. Consultants, familiar with the major issues and available to engage in problem-solving, can also ease the transition to distance education. School-based teams, comprised of parents, administrators, teachers, and students, also foster a sense of program ownership, and team members become partners in creating solutions.

This is also a perfect time to offer small grants to teachers as incentives to experiment with creative, integrative applications of the new technologies. For example, once a satellite and video equipment are in place, many activities can be invented to take advantage of them. Students in one school prepare and deliver a daily news program via a closed-circuit connection that uses distance education equipment.

It is tempting to designate all available resources for the hardware alone. but experience has shown this to be shortsighted. For example, Alaska invested millions of dollars into construction of a technological delivery system, but did not provide money for the programming and the human component. Ultimately the state discovered that if you ignore human resources you can end up with hardware that is not utilized. "We had consistent difficulty obtaining long-range commitments to funding the support elements once the glamor of the new equipment purchase had faded" (Bramble 1988, p. 253).

Conclusion

This Bulletin is not intended to make readers experts in the area. Instead, it has attempted to provide an overview of distance education as it now stands, paying particular attention to concerns of administrators who are thinking about introducing distance education into their districts.

It has answered some questions and raised others, as well as provided resources that may be useful to those who wish to find out more about this topic. If the Bulletin helps educators avoid some mistakes and unnecessary expenditures, then it will have served its intended purpose.

Appendix A: Glossary of Distance Education Terms

Microwave: High-frequency radio waves used for point-to-point and omni-directional communication of audio, data, and video signals.

Instruction Television Fixed Services: A band of microwave frequencies set aside by FCC exclusively for the transmission of educational programming. Allows broadcast of audio, video, and data to receive sites located within twenty miles. Receive sites require a converter that changes signals to those used by a standard televison set.

Uplink: An originator of programming, which then sends its signals up to a satellite transponder.

Downlink: A receiver dish that captures the programming for display.

Compressed Video: A digital transmission technique used to transmit a video channel that takes less bandwidth but compromises quality. Picture quality is generally not as good as full-motion; quick motions often appear blurred.

Asynchronous: This type of communication is two way and occurs with a time delay that allows participants to respond at their own convenience. Electronic mail is an example.

Appendix B: Resources on Distance Learning

Distance Education Providers

ASTS Oklahoma State University
408 Classroom Building
Stillwater, OK 74078

Satellite Telecommunications
Educational Programming (STEP)
East 4022 Broadway
Spokane, WA 99202

Technical Education Research
Center (TERC)
1696 Massachusetts Ave.
Cambridge, MA 02138

TI-IN Network, Inc.
1000 Central Parkway North
San Antonio, TX 78232

Database Providers

BRS Information Technologies
1200 Route 7
Latham, NY 12110

Dialog Information Services, Inc.
3460 Hillview Avenue
Palo Alto, CA 94304

Magazines/Journals

American Journal of Distance Education
Electronic Learning
Educational Technology
Journal of Rural and Small Schools
Media and Methods
Media in Education and Development
NAASP Bulletin
School Business Affairs
School Leader
Teaching at a Distance
Technology and Learning
The Computing Teacher

Organizations

National School Boards
Association's Transfer of Technology to Education
1680 Duke Street
Alexandria, Virginia 22314

International Society for Technology in Education (ISTE)
1787 Agate St.
Eugene, Oregon 97403

ISTE Special Interest Group for
Telecommunications (SIG/Tel)
International Society for Technology in Education (ISTE)
1787 Agate St.
Eugene, Oregon 97403

Regional Educational Research
Laboratories
(Located around the United States, these organizations frequently have research on local activities in the area of distance education)

Books

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Power On! U.S.Congress, Office of Technology Assessment, U.S. Government Printing, Washington, D. C. OTA-SET-379 ed., 1988

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